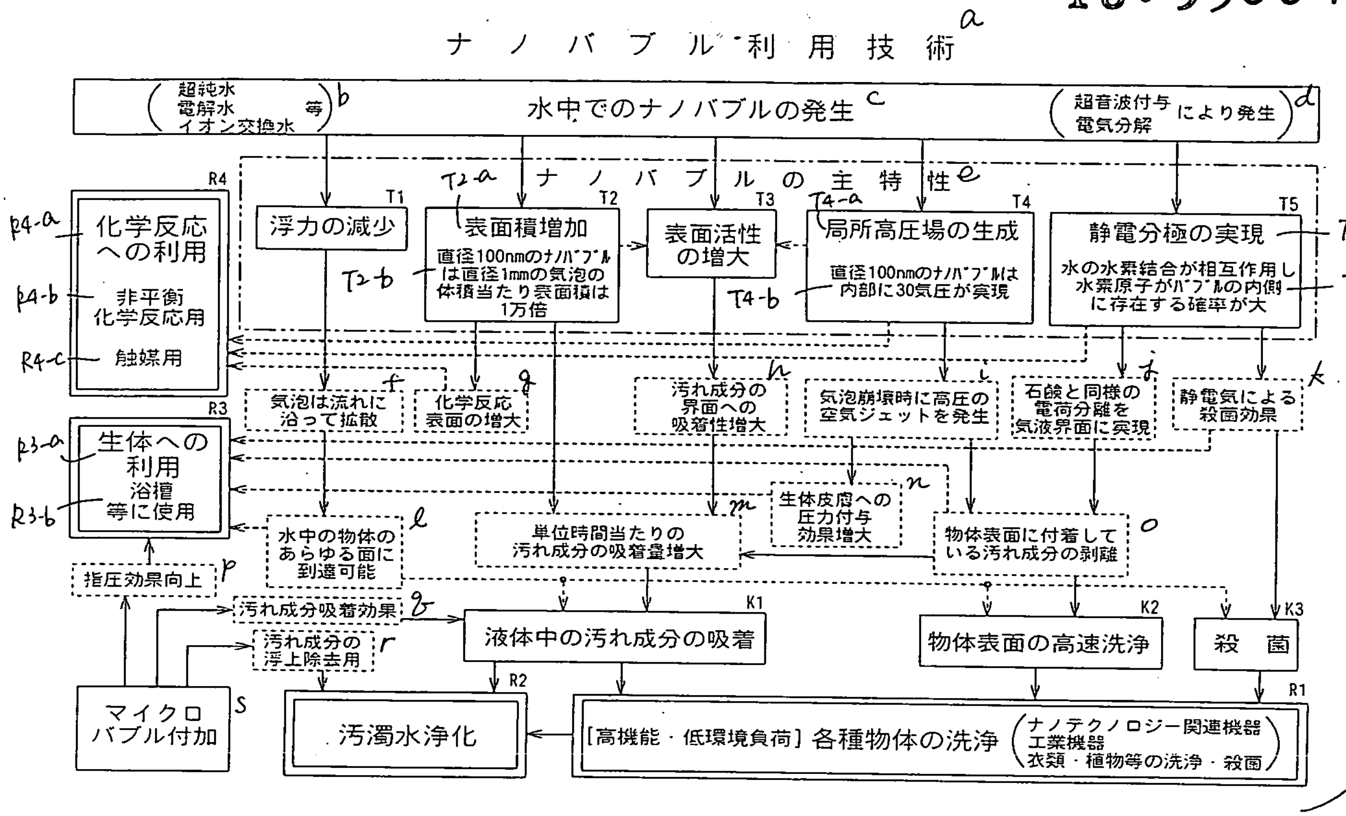
10/530047

FIG. 1

第1図



a. NANOBUBBLE UTILIZATION TECHNOLOGY
b. (ULTRA-PURE WATER, ELECTROLYZED WATER, ION-EXCHANGED WATER, AND SO FORTH)
c. GENERATION OF NANOBUBBLES IN WATER
d. (GENERATION BY APPLICATION OF ULTRASONIC WAVE AND ELECTROLYSIS)
e. MAIN FEATURES OF NANOBUBBLE
R4-a. USE FOR CHEMICAL REACTION
R4-b. APPLICATION TO NONEQUILIBRIUM CHEMICAL REACTION
R4-c. FOR CATALYST
T1. DECREASE OF BUOYANCY FORCE
T2-a. INCREASE OF SURFACE AREA
T2-b. SURFACE AREA OF NANOBUBBLE OF 100 nm DIAMETER IS 10,000 TIMES THAT OF AIR BUBBLE OF 1 mm DIAMETER
T3. INCREASE OF SURFACE ACTIVITY
T4-a. GENERATION OF LOCAL HIGH-PRESSURE FIELD
T4-b. PRESSURE IN NANOBUBBLE OF 100 nm DIAMETER IS 30 ATMS
T5-a. ESTABLISHMENT OF ELECTROSTATIC POLARIZATION
T5-b. PROBABILITY THAT HYDROGEN ATOMS ARE PRESENT INSIDE BUBBLE IS HIGH BECAUSE HYDROGEN BONDS OF WATER INTERACT WITH ONE ANOTHER
R3-a. USE FOR ORGANISM
R3-b. USE FOR BATHTUB AND SO FORTH
f. BUBBLES DIFFUSE ALONG STREAM
g. INCREASE OF CHEMICAL REACTION SURFACE
h. INCREASE OF ADSORPTIBITY OF FOUL COMPONENTS ON INTERFACE
i. HIGH-PRESSURE AIR JET IS FORMED WHEN BUBBLE COLLAPSES
j. CHARGE SEPARATION IS REALIZED AT AIR-LIQUID INTERFACE LIKE THAT BY SOAP
k. STERILIZATION EFFECT BY STATIC ELECTRICITY
l. CAN REACH ANY SURFACE OF OBJECT IN WATER
m. INCREASE OF AMOUNT OF FOUL COMPONENTS ADSORBED PER UNIT TIME
n. ENHANCEMENT OF EFFECT OF EXERTING PRESSURE ON ORGANISM SKIN
o. SEPARATION OF FOUL COMPONENTS ADHERING TO OBJECT SURFACE
p. ENHANCEMENT OF ACUPRESSURE EFFECT
q. FOUL COMPONENT ADSORPTION EFFECT
r. FOR FLOTATION REMOVAL OF FOUL COMPONENTS
K1. ADSORPTION OF FOUL COMPONENTS IN LIQUID
K2. HIGH-SPEED CLEANING OF OBJECT SURFACE
K3. STERILIZATION
s. IMPARTING OF MICROBUBBLES
R2. PURIFYING OF POLLUTED WATER
R1. (HIGH-PERFORMANCE & LIGHT ENVIRONMENTAL LOAD) CLEANING OF VARIOUS OBJECTS (CLEANING AND STERILIZATION OF NANOTECHNOLOGY-ASSOCIATED EQUIPMENT, INDUSTRIAL EQUIPMENT, CLOTHES, PLANTS, AND SO FORTH)

FIG. 2

第2図

ELECTROLYTIC SEPARATION PHENOMENON SIMILAR TO SOAP ON NANOBUBBLE SURFACE

ナノバブルの表面における石鹸類似の電解分離現象

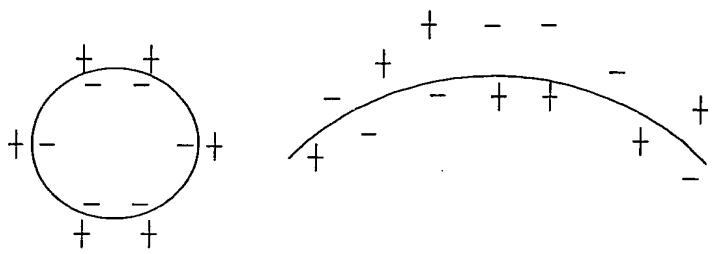
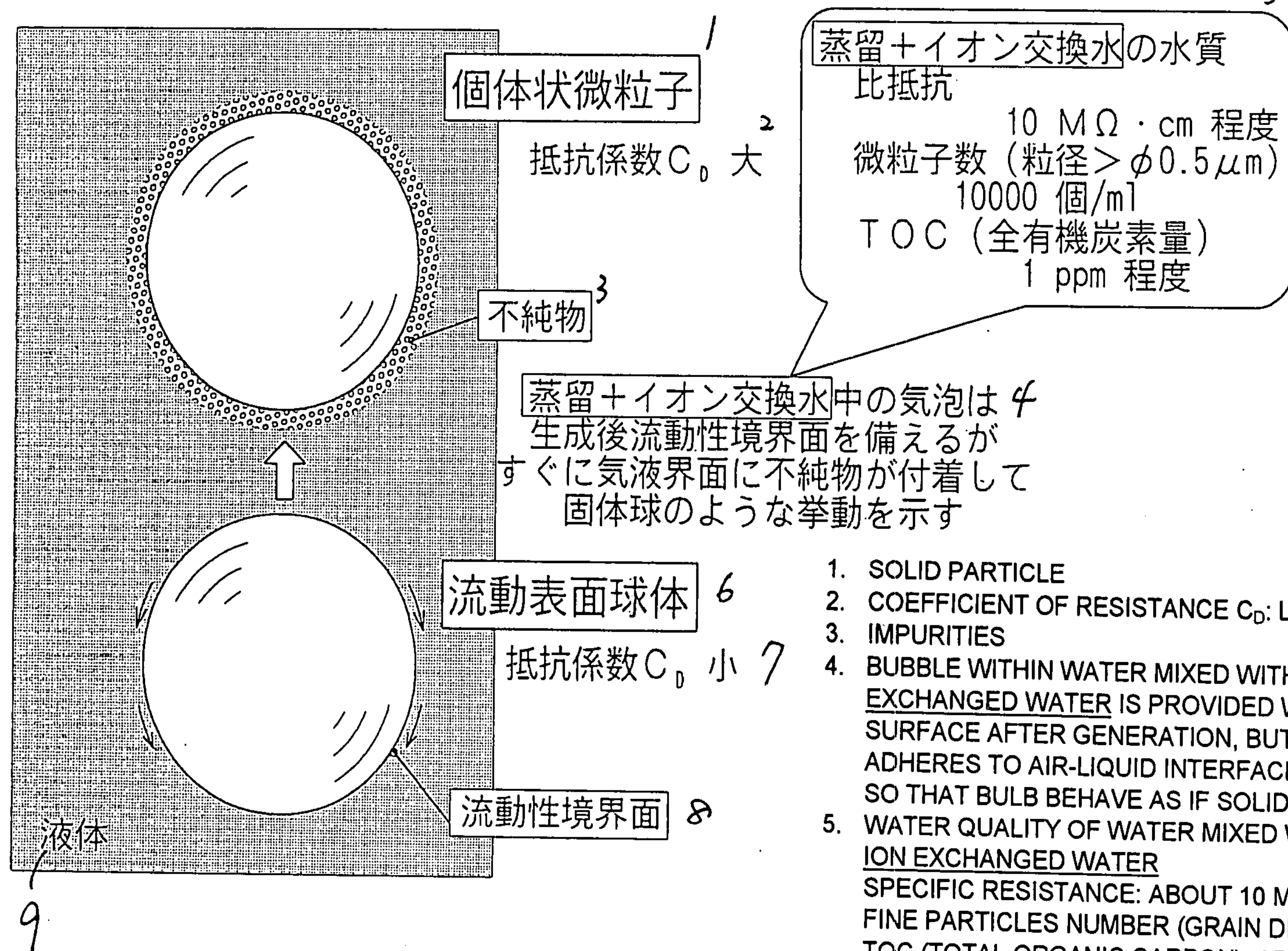


FIG. 3

~~第3図~~



1. SOLID PARTICLE
2. COEFFICIENT OF RESISTANCE C_D: LARGE
3. IMPURITIES
4. BUBBLE WITHIN WATER MIXED WITH PURE WATER AND ION EXCHANGED WATER IS PROVIDED WITH LIQUIDITY BOUNDARY SURFACE AFTER GENERATION, BUT IMPURITIES IMMEDIATELY ADHERES TO AIR-LIQUID INTERFACE SURFACE OF TO BULB, SO THAT BULB BEHAVE AS IF SOLID SPHERE
5. WATER QUALITY OF WATER MIXED WITH PURE WATER AND ION EXCHANGED WATER
   SPECIFIC RESISTANCE: ABOUT 10 MΩ•cm
   FINE PARTICLES NUMBER (GRAIN DIAMETER > φ0.5 μM): 10,000/ml
   TOC (TOTAL ORGANIC CARBON): ABOUT 1 PPM
6. LIQUIDITY BOUNDARY SURFACE SPHERE
7. COEFFICIENT OF RESISTANCE C_D: SMALL
8. LIQUIDITY BOUNDARY SURFACE
9. LIQUID

FIG. 4

~~第4図~~

1. DEGREE OF POLLUTION OF WATER
2. WATER QUALITY OF PERIPHERY OF BUBBLE
3. TOTAL ORGANIC CARBON
4. NUMBER OF FINE PARTICLES (NUMBER/ML) WITHIN WATER
5. GAS WITHIN BUBBLE
6. NUMBER OF FINE PARTICLES = 6/ml
7. TOTAL ORGANIC CARBON
8. SOLID PARTICLE
9. LIQUIDITY BOUNDARY SURFACE SPHERE
10. WATER MIXED WITH PURE WATER AND ION EXCHANGED WATER
11. RESISTANCE COEFFICIENTS
12. REYNOLDS NUMBERS

(a)

水の汚れ度合い 1

(i) 気泡周囲の水質 2 (ppb)

水中の微粒子数(個/ml) 4 \ 全有機炭素量 3	5	7	12	16	19	27	198
4					▽		
11	.	◇	□			○	
15					△		
40	×			+			▼
320					▲		

(ii) 気泡中の気体 5

	Air	N_2	He	Purified N_2
微粒子数＝6個／ml 6 全有機炭素量(TOC)＝6ppb 7	●	■	◆	⊡

(b)

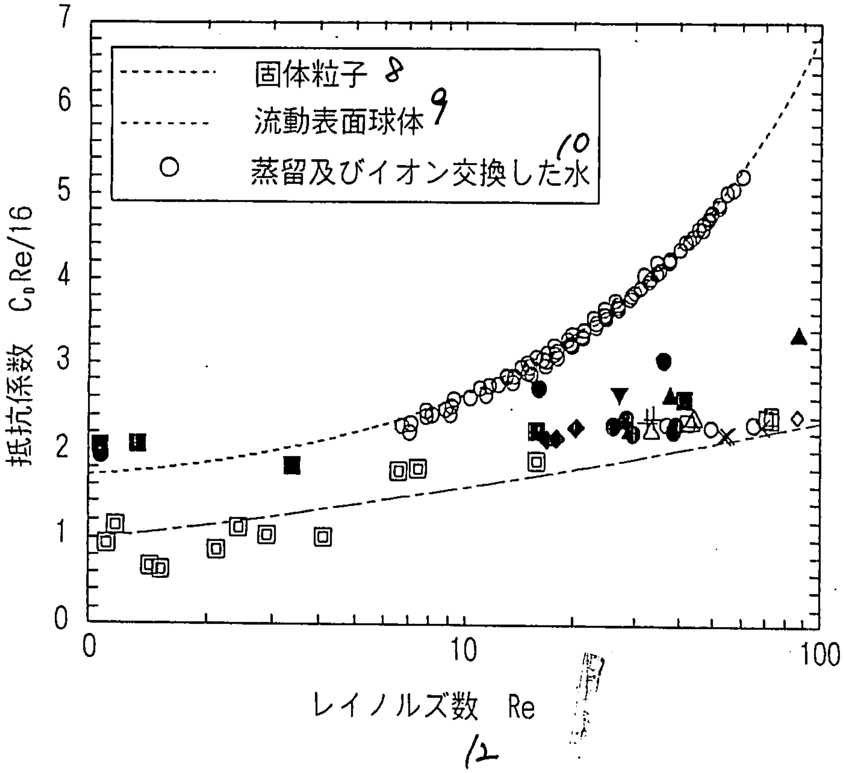
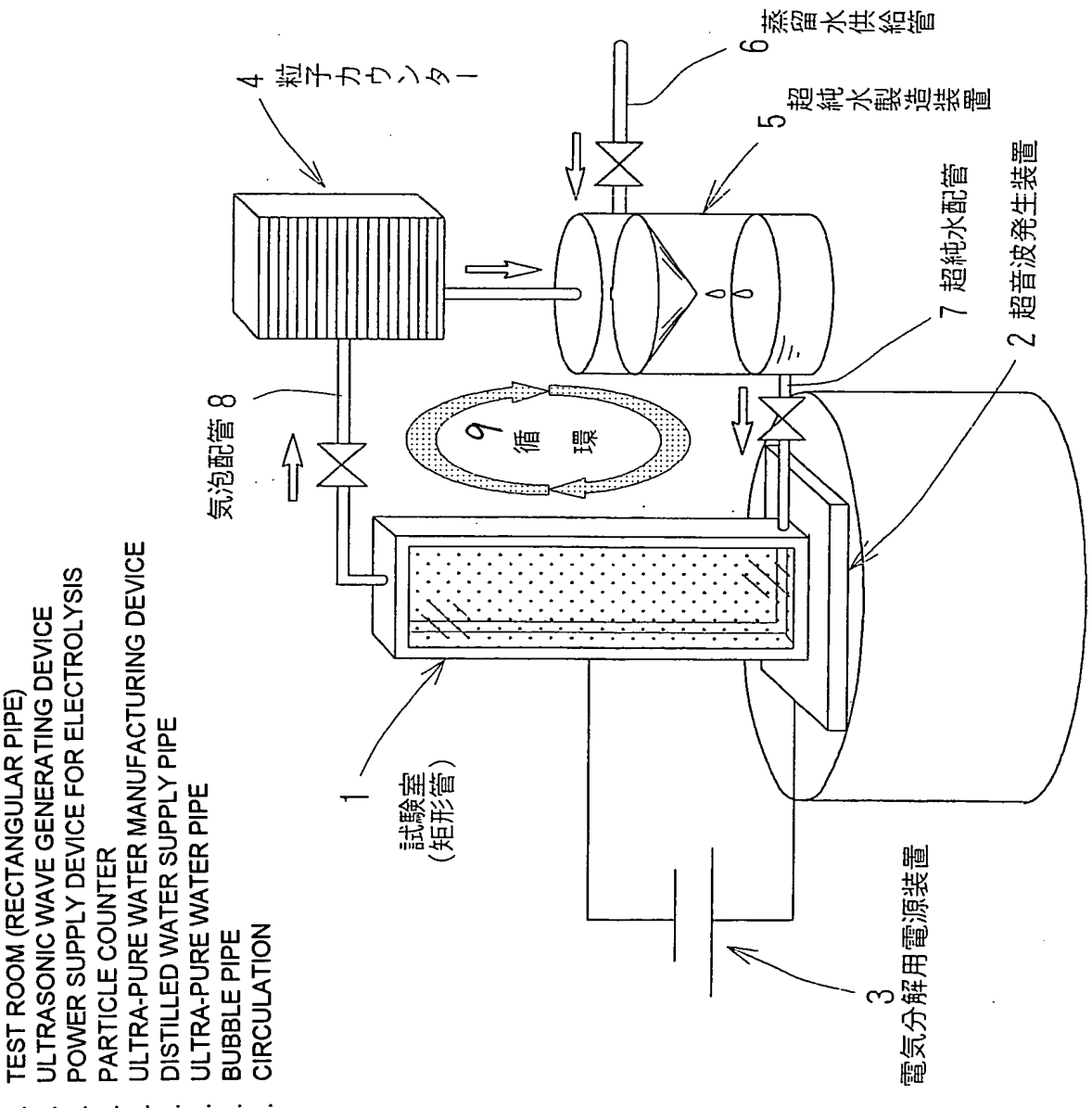


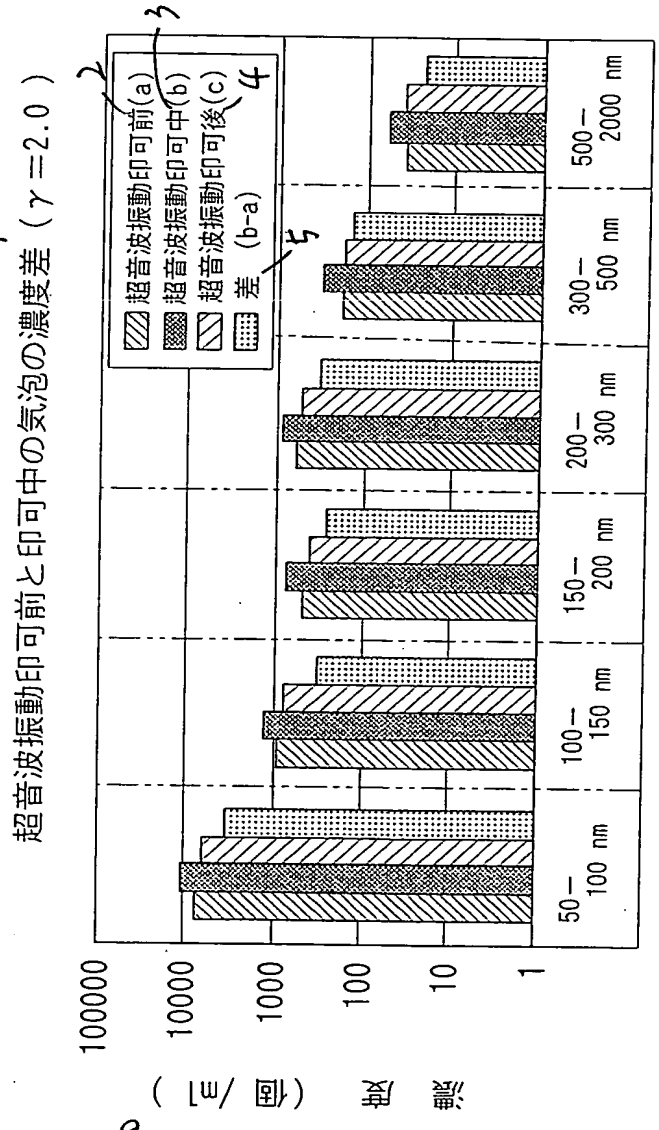
FIG.5

~~第5図~~



1. TEST ROOM (RECTANGULAR PIPE)
2. ULTRASONIC WAVE GENERATING DEVICE
3. POWER SUPPLY DEVICE FOR ELECTROLYSIS
4. PARTICLE COUNTER
5. ULTRA-PURE WATER MANUFACTURING DEVICE
6. DISTILLED WATER SUPPLY PIPE
7. ULTRA-PURE WATER PIPE
8. BUBBLE PIPE
9. CIRCULATION

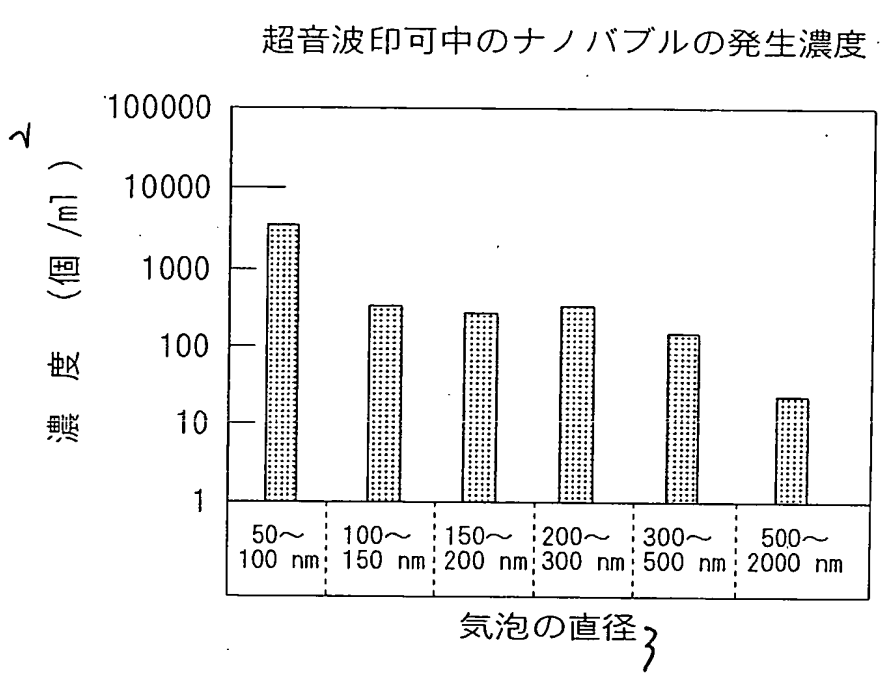
FIG.6
第6図



1. DIFFERENCE OF DENSITIES OF BUBBLES BETWEEN BEFORE APPLICATION OF ULTRASONIC WAVE VIBRATION AND DURING APPLICATION THEREOF
2. BEFORE APPLICATION OF ULTRASONIC WAVE VIBRATION
3. DURING APPLICATION OF ULTRASONIC WAVE VIBRATION
4. AFTER APPLICATION OF ULTRASONIC WAVE VIBRATION
5. DIFFERENCE (B - A)
6. DENSITY (NUMBER/ml)
7. DIAMETER OF BUBBLE

FIG.7

第7図



1. DENSITY OF NANOBUBBLES GENERATED DURING APPLICATION OF ULTRASONIC WAVE
2. DENSITY (NUMBER/ml)
3. DIAMETER OF BUBBLE